DEVELOPMENT OF WEB-BASED SOLAR PV POWERED WEATHER STATION

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ABSTRACT

The weather station is an important component in achieving optimum plant monitoring and planning. The weather station will be able to measure changes in weather station parameter .In this project, the main objective is to provide real-time measurement weather station monitored system via website. This simple weather station will be powered by solar photovoltaic (PV). Solar PV will be used because it is environmental friendly. The weather station will show environmental parameters like temperature, humidity and rain gauge only. Then, the data will be updated every second in the website development. LabView is software that will be used for user interfacing and NI USB-6216 DAQ card is used to collect data from weather station parameter. This will give a low-cost solution for remote place because no longer need to go to the weather station to check the data that has been received from the weather station.

ABSTRAK

Stesen cuaca merupakan komponen penting dalam pencapaian loji optimum dan perancangan. Stesen cuaca dapat mengukur perubahan dalam cuaca. Dalam data dari parameter stesen cuacaprojek ini, objektif utama ialah untuk menyediakan masa nyata sistem pengukuran stesen cuaca melalui laman web. Stesen cuaca ringkas ini dikuasakan oleh solar PV. Solar PV digunakan kerana ia mesra alam. Stesen cuaca ini akan menunjukkan parameter stesen cuaca seperti suhu, kelembapan, dan tolok hujan sahaja. Kemudian, data dari stesen cuaca akan dikemaskini setiap saat dalam penbangunan dalam laman sesawang. LabView ialah perisian yang digunakan untuk perantaraan pengguna dan kad NI USB-6216 digunakan untuk mengumpul data daripada parameter stesen cuaca. Ini akan memberikan pengurangan kos untuk tempat yang jauh kerana tidak lagi perlu pergi ke stesen cuaca untuk menyemak data yang diterima dari stesen cuaca.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, weather station is one of a part of daily life. Weather stations help people to do forecasting to help people in planning social and economy such as tourism, transportation, marine activity and plantation. Some of the weather station is placed in a remote place to monitor weather station parameter at that place. This situation will cause a problem if the place is far from main station that needs to monitor the weather station periodically. To hire someone to monitor the weather station periodically will cost a lot of money. Based on that problem, the web based solar PV powered weather station is developed to overcome that problem.

For this project, a website is develop to monitor the weather station parameter. This simple weather station will monitor temperature, percentage humidity, and water level in rain gauge. A DAQ card, NI USB-6216 is used to collect all weather station parameter. Then, LabView software is used to interface the weather station parameter into computer. Which will allow the weather station parameter being monitored by the

computer. Web publishing tool in LabView software is used to enable the weather station parameter viewed in the website. To improve the project, solar PV is used to power the weather station.

1.2 Problem Statement

Some of the weather station need to be placed in a remote place. Nowadays, we can find several type of weather station in a market, but most of the weather station cannot be monitored in remote place. Without a long distance monitoring system, this will cause a problem. An extra cost is needed to monitor the weather station time by time. By developing the web based solar powered weather station, the problem hopefully can be solved.

1.3 Objective

The objectives of this project are;

i. To provide real-time measurement weather station parameter monitored systems via website.
ii. To use software that will synchronize measurement data from sensor and real data measurement.

iii. To build a weather station that can measure temperature, humidity and rain gauge.
iv. To build weather station that can be powered by solar PV.
v. To build a system that more green and reduce cost operation in long term.

1.4 Scope of Project

There are several scope of this project which are:

i. The weather station will measure temperature, humidity and raid gauge only.
ii. The weather station can be monitored via website.

This weather station has three parameters, that is temperature, humidity and rain gauge. All these parameters are measured by receiving data from each parameter sensor and all the parameters can be monitored via website that already design to show the data parameter.

CHAPTER 2

LITERATURE REVIEWS

2.1 Digital weather station

This journal is proposed to build a weather station with a digital display. This weather station is powered by power supply. The analog signal from sensors is convert to digital. The weather station parameter will digital output. The weather station will provide reading parameter for pressure, rainfall, temperature, humidity, wind direction and wind speed and only can display one parameter from the weather station at one time. [1].

2.2 Real-time, Web based energy meter monitoring system for a solar academic building

This paper is using web based to monitor energy meter system for a solar academic building in their universities. It provides real-time data for energy flow from

the PV array minutes-by-minutes and also provide the summary performance. Their goals are to monitored total building energy consumption and monitor the performance of PV module and the information is available to everyone using world wide web(www) [2].

2.3 Development of web based power quality

This project is about a development of web based to do power quality monitoring. A computer server is use to monitored data and use internet to upload the monitored data into Tomcat web server. The monitoring software is software which control the power quality trough TCP/IP connectivity and use java technology. Beside that, HIOKI 3196 is use as power quality analyzer and that device have Ethernet and RS232 connectivity [3].

2.4 Monitoring system of a weather station via IP

From this journal, they also develop a monitoring system for weather station. They convert analog signal from sensor to digital to be read by computer via data acquisition card usb-6009 and using LabView application as application software to interface the data from weather station. The difference this project is monitored via. This method can cause a problem when people need to have a certain IP to enable them to monitored the weather station and it will also cause problem when the IP of the weather station is change [4].

2.5 A LabView based Data Acquisition System for Vibration Monitoring and Analysis

Based on this paper, the author using a LabView software to develop a system for vibration monitoring and analysis using data acquisition card (DAQ card). They use the DAQ card to monitor vibration in machine-mounted sensor and do analysis from data that has been collected from DAQ card. For this project, a piezoelectric accelerometer sensor is used to monitor the vibration [5].

2.6 Architecture for Remote Laboratories based on REST Web Services

In this paper, a new architecture for remote laboratories based on REST (Representational State Transfer) web services is proposed. The proposed platform use languages such as HTML, AJAX (asynchronous Javascript and XML) and LabView. A web browser is the client interface and on the server side runs an application based on LabView 8.6 with REST web resources. For this project, they use NI USB-6009 DAQ card and first-order active filter as input to monitored [6].

2.7 Real-time Monitoring System of PLC for Production Line of Coin Cell Battery Based on LabVIEW

This paper proposes a project using LabView software to implement the real-time monitoring system of PLC for production line of coin cell battery. It introduces the principle of its composition and some command formats. The system implements the equipment production monitoring and analysis of field data by using the data processing capabilities and the user friendly interface of Labview software. The experiment proves that the system has high stability and realizes production line real-time monitoring various working parameters [7].

CHAPTER 3

METHODOLOGY

3.1 Block Diagram

Figure 3.1 shows a block diagram of the project which starts with solar panel. The power that generated from the solar panel will transfer to charger controller and the charger will control charging process of the battery. When the battery need to be charged, the charger controller will allow the power from solar panel to charge the battery and when the battery is full, the charger controller will stop the charging process. The battery will supply power to the humidity sensors, temperature sensor, and water level sensor. All the sensors will measure weather parameter and give an analog output voltage. Data acquisition card function is to receive an analog voltage from the sensors and convert it to digital signal. The digital signal then will be transfered to the computer via USB port. In the computer, LabView software is used to read the DAQ card, control and calculate the output from weather station sensor to real value data value and display in front panel. Lastly, the weather station data in LabView front panel will be uploaded to the website via LabView web service.

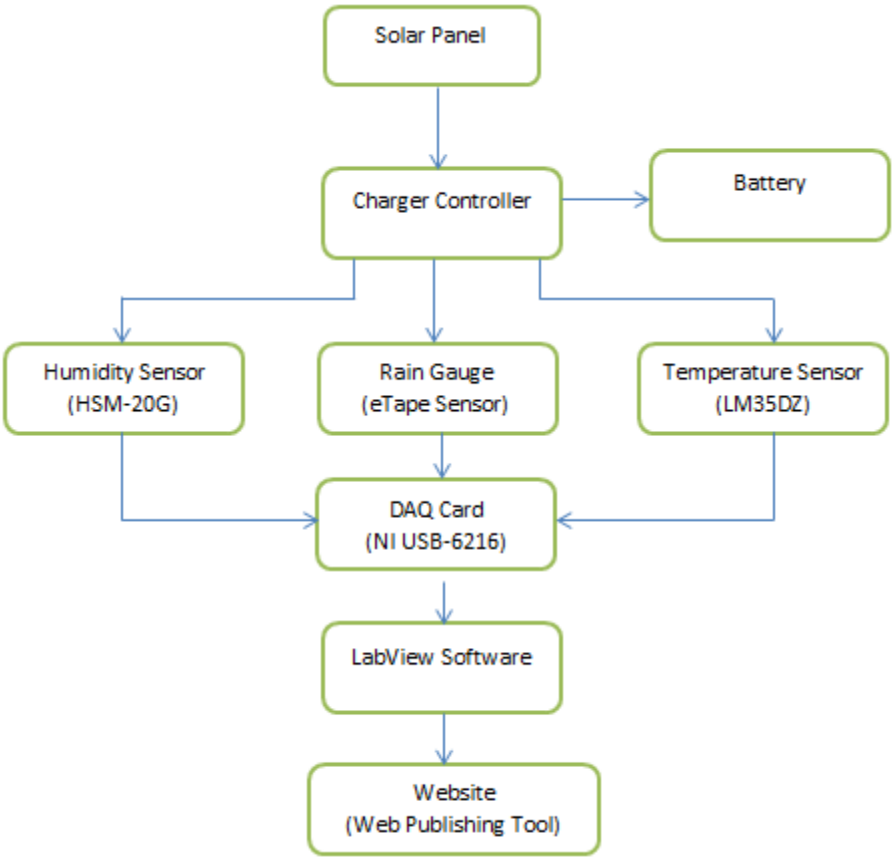

Figure 3.1: Block diagram

3.2 Hardware Connection

Figure 3.2 shows the connection between hardware for the weather station that powered by solar PV. The solar panel and battery connected. The battery then connects to the weather station at positive terminal and negative terminal to power the weather station sensors. Then the sensors output data will be collected by NI USB-6216 (DAQ card) and transmit to the computer.

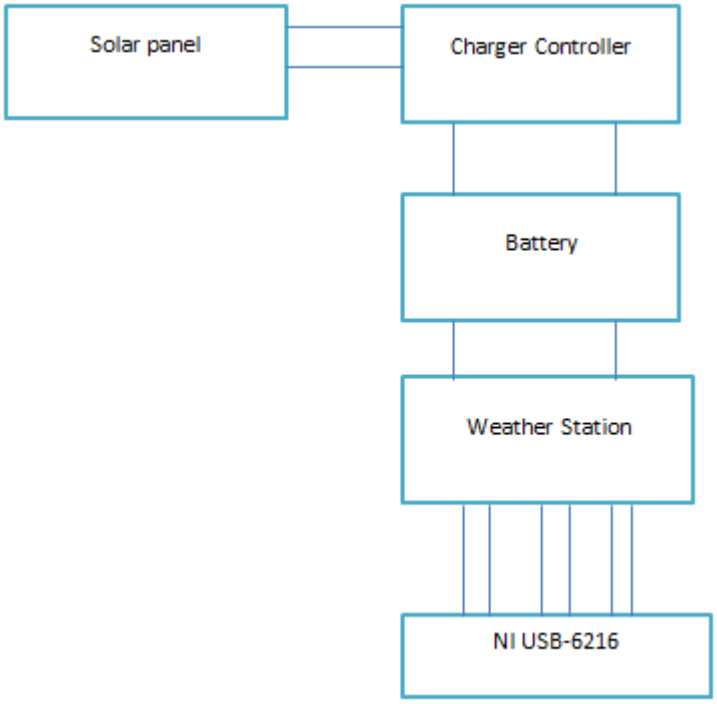

Figure 3.2: Connection between hardware

The complete connection between hardware is show in figure 3.3.

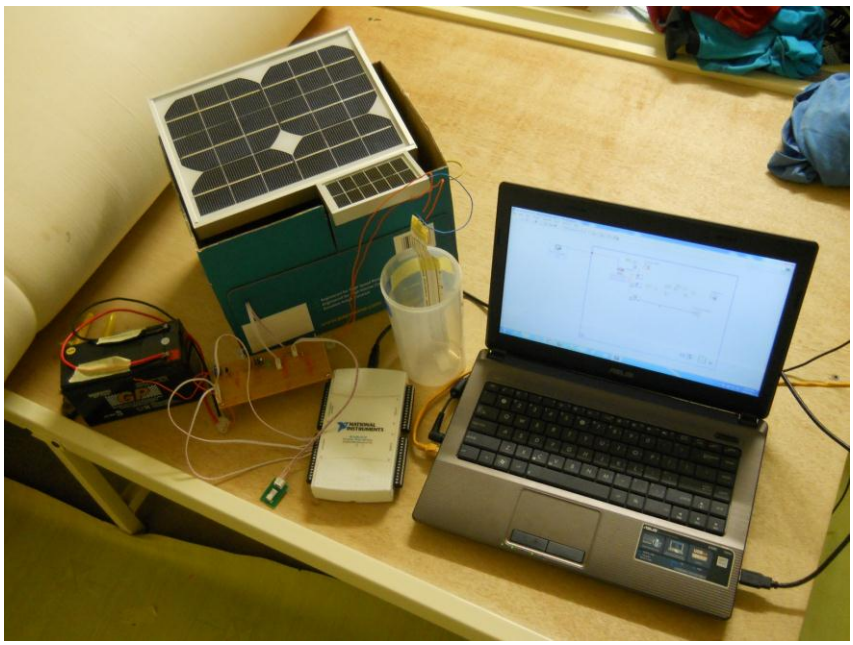

Figure 3.3: complete connection between hardware

3.3 Weather Station Circuit Overview

Figure 3.4 shows the weather station circuit. 12VDC input voltage will powered temperature sensor (LM35DZ) and voltage regulator (L7805). The voltage regulator will convert 12V DC source to 5V DC. 5V output voltage from voltage regulator will powered humidity sensor and water level sensor. Output voltage for each sensor is measured via each resistor.

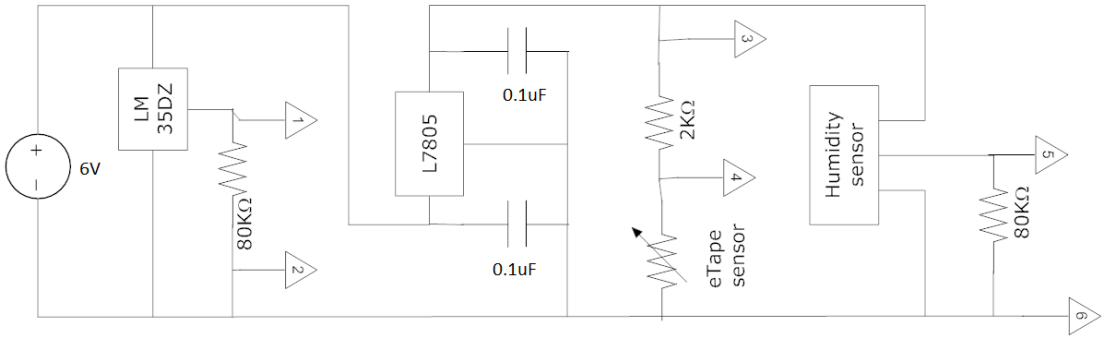

Figure 3.4: Weather station circuit

3.4 Hardware Implementation

3.4.1 Temperature Sensor

For the temperature sensor, LM35DZ in figure 3.5 is used because this sensor can measure temperature more accurately than using thermistor. Besides that, the sensor circuitry is sealed and not subject to oxidation. Lastly, compared to thermocouples, LM35DZ generates a higher output voltage than thermocouples and may not require the output voltage amplified.

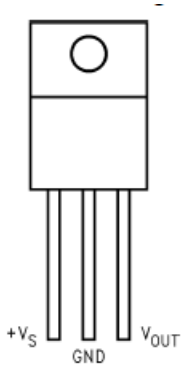

Figure 3.5: LM35DZ overview

Figure 3.6 shows that the output voltage from LM35DZ is proportional to the Celsius temperature. The scale factor is 0.01V/°C. Method to measure temperature from the sensor is by measuring voltage at resistor R_a. Figure 3.7 shows the connection used for the temperature sensor.

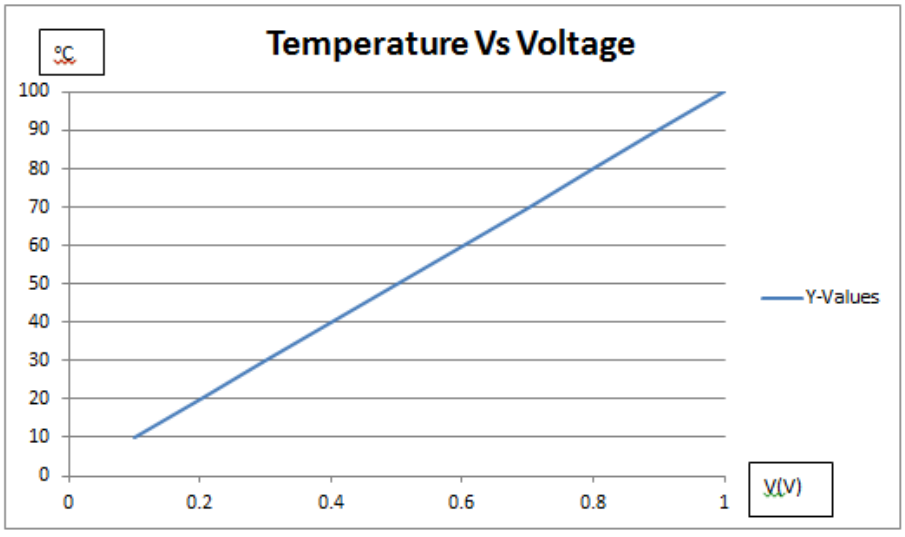

Figure 3.6: Relationship between voltage and temperature

Figure 3.7 shows how the output voltage from temperature sensor is measure. The voltage dissipate voltage at R_a is equal to output voltage from temperature sensor.

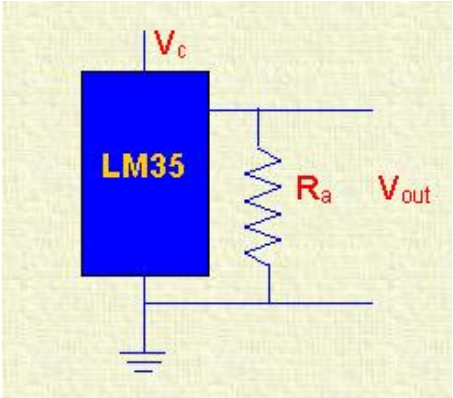

Figure 3.7: LM35DZ circuit connection

3.4.2 Humidity Sensor

HSM-20G humidity sensor module is used to measure percentage of humidity and give an output voltage as value of measurement. Figure 3.8 shows the connection to read voltage output from the humidity sensor. Value for R_2 is 80KΩ. The voltage output is depending on percentage of humidity surrounding. Relationship between voltage output and percentage humidity is display in table 1 and figure 3.9.

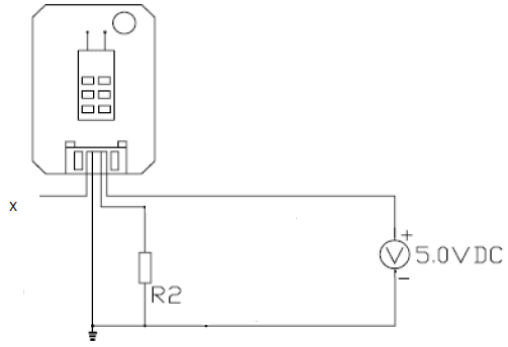

Figure 3.8: HSM-20G connection

Table 3.1: HSM-20G characteristic

Humidity /%	10	20	30	40	50	0	70	80	80
Voltage output (V)	0.74	0.95	1.31	1.68	2.02	2.37	2.69	2.99	3.19

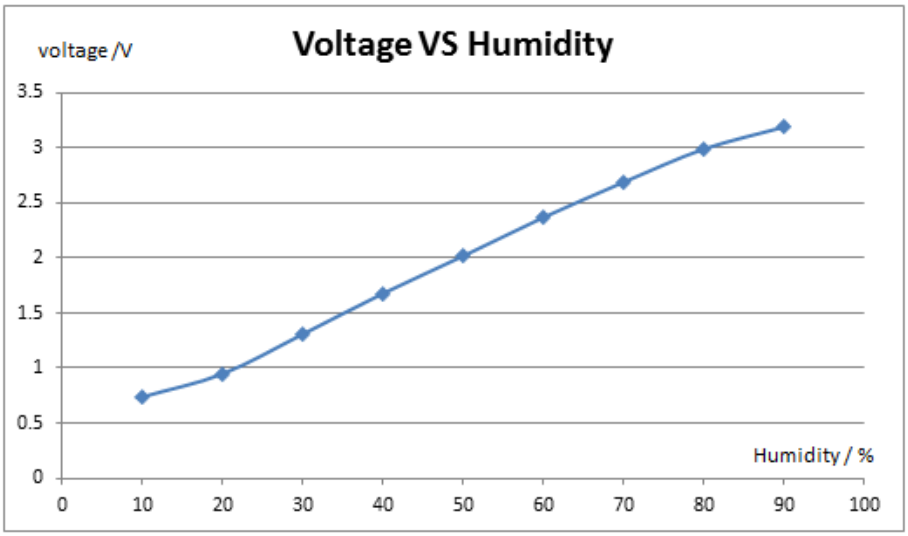

Figure 3.9: Relationship between voltage output and humidity